In re Patent Application of
CATTANEO ET AL.
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In the Claims:

Claims 1-22 (Cancelled).

23. (New) A method for synchronizing a data device operating in a wireless data communications system using an incident pulsed signal of an ultra wide band type received over a channel by the data device, the incident pulsed signal comprising a preamble including a training sequence having a series of pulses whose polarity and time shifts are defined by respective polarity and time-hopping codes, the method comprising:

cross-correlating the incident pulsed signal with the training sequence, the cross-correlating comprising algebraically summing in accordance with the polarity code, windows of the incident pulsed signal, with starting points of the windows being determined by the time-hopping code; and

detecting an end point of the preamble based upon a result of the cross-correlation.

24. (New) A method according to Claim 23, wherein the training sequence is periodic and comprises replicas, with each training sequence having a size of N samples and containing L pulses, with each window having a size of N samples, with the cross-correlating being performed iteratively in a block-by-block fashion until a stop criterion is reached, with the starting points of two consecutive blocks of correlation being separated by 2N samples, and for each iteration the cross-correlating comprising:

a) initializing contents of an accumulation register capable of storing N data;

b) taking a first group of N samples of the incident

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pulsed signal starting from the starting point of the corresponding block increased by a time shift of a first pulse;

c) multiplying the first group by the polarity of the first pulse;

d) adding the resulting group of N samples to the contents of the accumulation register; and

e) repeating steps b) to d) for all the L pulses.

25.   (New) A method according to Claim 23, wherein the training sequence is periodic and comprises at least M+1 replicas, with each replica having a size of N samples and containing L pulses, with M being a sub-multiple of N greater than or equal to 2, with the cross-correlating being performed iteratively in a block-by-block fashion until a stop criterion is reached, the computation of each block being split into M slices which are computed by algebraically summing windows N/M samples long.

26.   (New) A method according to Claim 25, wherein the incident signal carries information within a super frame, each super frame containing the preamble including at least M+1 synchronization slots corresponding respectively to the replicas of the training sequence, and each slice being computed using one synchronization slot.

27.   (New) A method according to Claim 26, wherein the starting points of two consecutive blocks of correlation are separated by N + N/M samples, with each iteration the cross-correlating comprising:

a) initializing contents of an accumulation register

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capable of storing N/M data;

   b) taking a first group of N/M samples of the incident pulsed signal starting from the starting point of the corresponding block increased by a time shift of a first pulse;

   c) multiplying the first group by the polarity of the first pulse;

   d) adding the resulting group of N/M samples to the contents of the accumulation register; and

   e) repeating steps b) to d) for all the L pulses.

   28. (New) A method according to Claim 25, wherein the incident pulsed signal carries information within a super frame, with each super frame containing the preamble including at least M+1 synchronization slots corresponding respectively to the replicas of the training sequence, and each slice being computed using several adjacent synchronization slots belonging to several consecutive super frames.

   29. (New) A method according to Claim 28, wherein after each correlation iteration, further comprising comparing the contents of the accumulation register with a first threshold; and wherein the stop criterion comprises detecting at least one peak of the accumulation register having a value greater than the first threshold or a maximum number of correlation iterations.

   30. (New) A method according to Claim 29, wherein the detecting comprises a first step of detecting one replica of the training sequence, the first step comprising storing in a memory the position of each peak in the accumulation

register as well as its sign.

31.   (New) A method according to Claim 30, wherein
the preamble contains an additional flipped last replica of
the training sequence; and wherein the detecting further
comprises a second step of sequentially scanning the next
replicas until the flipped last replica is found.

32.   (New) A method according to Claim 31, wherein
scanning a next replica comprises:
        performing a correlation between the next replica
and the training sequence; and
        comparing a result of the correlation with a second
threshold, and if the absolute value of the correlation result
exceeds the second threshold, using the sign of the
correlation result and the sign of each detected peak to
decide whether the next replica is the last one or if the
scanning operation is to be performed with the replica
following the next replica.

33.   (New) A method according to Claim 24, wherein
after each correlation iteration, further comprising comparing
the contents of the accumulation register with a first
threshold; and wherein the stop criterion comprises detecting
at least one peak of the accumulation register having a value
greater than the first threshold or a maximum number of
correlation iterations.

34.   (New) A method according to Claim 33, wherein
the detecting comprises a first step of detecting one replica
of the training sequence, the first step comprising storing in

a memory the position of each peak in the accumulation
register as well as its sign.

35.   (New) A method according to Claim 34, wherein
the preamble contains an additional flipped last replica of
the training sequence; and wherein the detecting further
comprises a second step of sequentially scanning the next
replicas until the flipped last replica is found.

36.   (New) A method according to Claim 35, wherein
scanning a next replica comprises:
        performing a correlation between the next replica
and the training sequence; and
        comparing a result of the correlation with a second
threshold, and if the absolute value of the correlation result
exceeds the second threshold, using the sign of the
correlation result and the sign of each detected peak to
decide whether the next replica is the last one or if the
scanning operation is to be performed with the replica
following the next replica.

37.   (New) A method according to Claim 23, wherein
the wireless data communications system comprises a wireless
personal area network of the piconet type.

38.   (New) A data device comprising:
        a receiver for receiving an incident pulsed signal
of an ultra wide band type over a channel, the incident pulsed
signal comprising a preamble including a training sequence
having a series of pulses whose polarity and time shifts are
defined by respective polarity and time-hopping codes; and

a synchronizer comprising

a cross-correlation circuit for performing a cross-correlation of the incident pulsed signal with the training sequence, the cross-correlating including algebraically summing in accordance with a polarity code, windows of the incident pulsed signal, with starting points of the windows being determined by the time-hopping code, and

a detection circuit for detecting an end point of the preamble based upon a result of the cross-correlation performed by said cross-correlation circuit.

39. (New) A data device according to Claim 38, wherein the training sequence is periodic and comprises replicas, with each training sequence having a size of N samples and containing L pulses, with each window having a size of N samples, and said cross-correlation circuit performing the cross-correlating iteratively in a block-by-block fashion until a stop criterion is reached, the starting points of two consecutive blocks of correlation being separated by 2N samples, said cross-correlation circuit comprising:

an accumulation register for storing N data; and

a processor adapted, for each iteration, to perform the following:

a) initializing contents of said accumulation register,

b) taking a first group of N samples of the received incident pulsed signal starting from the starting point of the corresponding block increased

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by the time shift of a first pulse,

  c) multiplying the first group by the polarity
of the first pulse,

  d) adding a resulting group of N samples to the
contents of said accumulation register, and

  e) repeating steps b) to d) for all the L
pulses.

  40. (New) A data device according to Claim 38,
wherein the training sequence is periodic and comprises at
least M+1 replicas, with each replica having a size of N
samples and containing L pulses, with M being a sub-multiple
of N greater than or equal to 2; and wherein said cross-
correlation circuit performs the cross-correlating iteratively
in a block-by-block fashion until a stop criterion is reached,
the computation of each block being split into M slices which
are computed by algebraically summing windows N/M samples
long.

  41. (New) A data device according to Claim 40,
wherein the incident pulsed signal carries information within
a super frame, each super frame containing the preamble
including at least M+1 synchronization slots corresponding
respectively to the replicas of the training sequence; and
wherein said cross-correlation circuit computes each slice
using one synchronization slot.

  42. (New) A data device according to Claim 41,
wherein the starting points of two consecutive blocks of
correlation are separated by N + N/M samples, said cross-
correlation circuit comprising an accumulation register for

storing N/M data, and a processor adapted for each iteration to perform the following:

a) initializing the contents of said accumulation register;

b) taking a first group of N/M samples of the incident pulsed signal starting from the starting point of the corresponding block increased by the time shift of a first pulse;

c) multiplying the first group by the polarity of the first pulse;

d) adding the resulting group of N/M samples to the contents of said accumulation register; and

e) repeating sub-steps b) to d) for all the L pulses.

43.	(New) A data device according to Claim 41, wherein the incident pulsed signal carries information within a super frame structure, with each super frame containing the preamble including at least M+1 synchronization slots corresponding respectively to the replicas of the training sequence; and wherein said cross-correlation circuit computes each slice using several adjacent synchronization slots belonging to several consecutive super frames.

44.	(New) A data device according to Claims 43, wherein said cross-correlation circuit comprises a comparator for comparing after each correlation iteration, the contents of said accumulation register with a first threshold, and wherein the stop criterion comprises detecting at least one peak of said accumulation register having a value greater than the first threshold or a predetermined maximum number of

correlation iterations.

45.   (New) A data device according to Claim 44, wherein said detection circuit comprises a memory and a store memory (STM) for storing in said memory a position of each peak in said accumulation register as well as its sign.

46.   (New) A data device according to Claim 45, wherein the preamble contains an additional flipped last replica (LFR) of the training sequence; and wherein said detection circuit comprising a scanning circuit for sequentially scanning the next replicas until the flipped last one is found.

47.   (New) A data device according to Claim 46, wherein said scanning circuit comprises:
        a correlation circuit for performing a correlation between the next replica and the training sequence; and
        a comparison means (CMPX) for comparing the correlation result with a second threshold; and
        a control circuit (CTLM) for, if an absolute value of the correlation result exceeds the second threshold, using a sign of the correlation result and a sign of each detected peak to decide whether the next replica is the last one or if the scanning operation is to be performed with the replica following the next replica.

48.   (New) A data device according to Claims 39, wherein said cross-correlation circuit comprises a comparator for comparing after each correlation iteration, the contents of said accumulation register with a first threshold, and

wherein the stop criterion comprises detecting at least one peak of said accumulation register having a value greater than the first threshold or a predetermined maximum number of correlation iterations.

49.   (New) A data device according to Claim 48, wherein said detection circuit comprises a memory and a store memory (STM) for storing in said memory a position of each peak in said accumulation register as well as its sign.

50.   (New) A data device according to Claim 49, wherein the preamble contains an additional flipped last replica (LFR) of the training sequence; and wherein said detection circuit comprising a scanning circuit for sequentially scanning the next replicas until the flipped last one is found.

51.   (New) A data device according to Claim 50, wherein said scanning circuit comprises:
        a correlation circuit for performing a correlation between the next replica and the training sequence; and
        a comparison means (CMPX) for comparing the correlation result with a second threshold; and
        a control circuit (CTLM) for, if an absolute value of the correlation result exceeds the second threshold, using a sign of the correlation result and a sign of each detected peak to decide whether the next replica is the last one or if the scanning operation is to be performed with the replica following the next replica.

52.   (New) A data device according to Claim 38,

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wherein the data device operates in a wireless data
communications system comprising a wireless personal area
network of the piconet type.

     53. (New) A wireless data communications system
comprising:

     a plurality of data devices, each data device
comprising

          a receiver for receiving an incident
pulsed signal of an ultra wide band type over a
channel, the incident pulsed signal comprising a
preamble including a training sequence having a
series of pulses whose polarity and time shifts are
defined by respective polarity and time-hopping
codes, and

          a synchronizer comprising

               a cross-correlation circuit for
performing a cross-correlation of the
incident pulsed signal with the training
sequence, the cross-correlating including
algebraically summing in accordance with a
polarity code, windows of the incident
pulsed signal, with starting points of the
windows being determined by the time-
hopping code, and

               a detection circuit for
detecting an end point of the preamble
based upon a result of the cross-
correlation performed by said cross-
correlation circuit.

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54.   (New) A wireless data communications system
according to Claim 53, wherein the training sequence is
periodic and comprises replicas, with each training sequence
having a size of N samples and containing L pulses, with each
window having a size of N samples, and said cross-correlation
circuit performing the cross-correlating iteratively in a
block-by-block fashion until a stop criterion is reached, the
starting points of two consecutive blocks of correlation being
separated by 2N samples, said cross-correlation circuit
comprising:

an accumulation register for storing N data; and
a processor adapted, for each iteration, to perform
the following:

a) initializing contents of said accumulation
register,

b) taking a first group of N samples of the
received incident pulsed signal starting from the
starting point of the corresponding block increased
by the time shift of a first pulse,

c) multiplying the first group by the polarity
of the first pulse,

d) adding a resulting group of N samples to the
contents of said accumulation register, and

e) repeating steps b) to d) for all the L
pulses.

55.   (New) A wireless data communications system
according to Claim 53, wherein the training sequence is
periodic and comprises at least M+1 replicas, with each
replica having a size of N samples and containing L pulses,
with M being a sub-multiple of N greater than or equal to 2;

and wherein said cross-correlation circuit performs the cross-correlating iteratively in a block-by-block fashion until a stop criterion is reached, the computation of each block being split into M slices which are computed by algebraically summing windows N/M samples long.

    56.   (New) A wireless data communications system according to Claim 55, wherein the incident pulsed signal carries information within a super frame, each super frame containing the preamble including at least M+1 synchronization slots corresponding respectively to the replicas of the training sequence; and wherein said cross-correlation circuit computes each slice using one synchronization slot.

    57.   (New) A wireless data communications system according to Claim 56, wherein the starting points of two consecutive blocks of correlation are separated by N + N/M samples, said cross-correlation circuit comprising an accumulation register for storing N/M data, and a processor adapted for each iteration to perform the following:
        a) initializing the contents of said accumulation register;
        b) taking a first group of N/M samples of the incident pulsed signal starting from the starting point of the corresponding block increased by the time shift of a first pulse;
        f) multiplying the first group by the polarity of the first pulse;
        g) adding the resulting group of N/M samples to the contents of said accumulation register; and
        h) repeating sub-steps b) to d) for all the L

pulses.

58.   (New) A wireless data communications system according to Claim 53, wherein the wireless data communications system comprises a wireless personal area network of the piconet type.